AIR QUALITY MODELING APPENDIX

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Air Quality Impact Technical Support Document

he following technical support document describes the processes used to conduct the air quality impact assessment, and provides summaries of relevant analysis data:

Argonne National Laboratory.
2002. Technical Support Document - Air Quality Impact Assessment for the Montana Statewide Final Oil and Gas EIS and Amendment of the Powder River and Billings Resource Management Plans and the Wyoming Final EIS and Planning Amendment for the Powder River Basin Oil and Gas Development Project. Prepared for the U.S. Department of the Interior, Bureau of Land Management, Montana and Wyoming State Offices, by the Environmental Assessment Division, Argonne National Laboratory. Argonne, Illinois.

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1.0 Introduction

Air pollution impacts are limited by local, state, tribal and federal air quality regulations, standards, and implementation plans established under the CAA and administered by the MDEQ and the EPA. Although not applicable to the proposed Alternatives, the WYDEQ has similar jurisdiction over potential air pollutant emission sources in Wyoming, which can have a cumulative impact with MDEQ approved sources. Air quality regulations require certain proposed new, or modified existing, air pollutant emission sources (including CBM compression facilities) undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees and control devices, prior to construction and/or operation.

Fugitive dust and exhaust from construction activities, along with air pollutants emitted during operation (i.e., well operations, field [booster] and sales [pipeline] compressor engines, etc.), are potential causes of air quality impacts. These issues are more likely to generate public concern where natural gas development activities occur near residential areas. The FS, NPS, and the FWS have also expressed concerns regarding potential atmospheric deposition (acid rain) and visibility impacts within distant downwind PSD Class I and PSD Class II areas under their administration, located throughout Montana, Wyoming, southwestern North Dakota, western South Dakota, and northwestern Nebraska.

2.0 Existing Air Quality

As described in **Chapter 3 - Affected Environment (Air Quality)**, specific air quality monitoring is not conducted throughout most of the CBM emphasis area, but air quality conditions are likely to be very good, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Air quality monitoring is the appropriate tool for determining compliance with the NAAQS for both particulate matter with an aerodynamic diameter equal to or less than ten microns in diameter (PM_{10}) and nitrogen dioxide (NO_2). As part of the Air Quality Impact Assessment prepared by Argonne National Laboratory (Argonne 2002), monitoring data measured throughout the southeastern Montana and northeastern Wyoming were assembled and reviewed. Although monitoring is primarily conducted in urban or industrial areas, the data selected are considered to be the best available representation of background air pollutant concentrations throughout the CBM emphasis area. Specific values presented in Table AQ-1 were used to define background conditions in the air quality impact analysis. The selected background pollutant concentrations are below applicable ambient air quality standards for all pollutants and averaging times. These National and Montana standards, and the PSD increment values, are also presented in Table AQ-1.

Note that for evaluating consumption of the PM_{10} and NO_2 increments in Montana and Wyoming, as well as on Indian Reservations, modeling performed by an air quality regulatory agency is the appropriate tool

TABLE AQ-1
ASSUMED BACKGROUND CONCENTRATIONS, APPLICABLE AMBIENT AIR QUALITY STANDARDS, AND PSD INCREMENT VALUES (IN (μG/M^3)

Pollutant	Averaging Time [a]	Background Concentration	National Ambient Air Quality Standards	Montana Ambient Air Quality Standards	PSD Class I Increment	PSD Class II Increment
Carbon Monoxide	1-hour	15,000	40,000	40,000	N/A	N/A
	8-hours	6,600	10,000	10,000	N/A	N/A
Lead	Quarterly	N/A	1.5	1.5	N/A	N/A
Nitrogen Dioxide	1-hour	117	N/A	566	N/A	N/A
	Annual	11	100	100	2.5	25
Ozone	1-hour	N/A	235	196	N/A	N/A
	8-hours	100	157	N/A	N/A	N/A
$PM_{2.5}$	24-hours	20	65	N/A	N/A	N/A
	Annual	8	15	N/A	N/A	N/A
PM_{10}	24-hours	105	150	150	8	30
	Annual	30	50	50	4	17
Sulfur Dioxide	1-hour	666	N/A	1,300	N/A	N/A
	3-hours	291	1,300	N/A	25	512
	24-hours	73	365	260	5	91
	Annual	16	80	60	2	20

Source: Argonne (2002)
Notes:
$\mu g/m^3$ - micrograms per cubic meter
[a] Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
N/A – data not available

(emissions solely from surface coal mines being the only exception). It should be noted that the BLM model used to identify and analyze impacts in this EIS is not intended or designed to be a regulatory PSD increment consumption modeling process.

Monitoring should be used to supplement modeling efforts, to:

1. Determine if identified levels of concern are exceeded, triggering the need to implement additional mitigation measures in order to avoid regulatory action
2. Provide additional indication of the need for regulatory modeling to determine if increments are being exceeded and an updated State Implementation Plan needed

The States of Wyoming and Montana will work with EPA to develop monitoring plans, which will consider population areas, modeled hot spots and other potential areas of concern. EPA will work with the Crow Tribe and Northern Cheyenne Tribe to identify the need for and to deploy additional monitoring as needed. The EIS predicts that full development of the Coal Bed Methane resource in

Montana, in culmination with non-project and RFFA sources, may generate criteria air pollutants (PM, VOCs and NOx) in sufficient quantities to require regulatory action on the part of MDEQ to protect both the PSD increments and the Montana and National Ambient Air Quality Standards. MDEQ will need to accurately predict the impacts of proposed projects during the New Source Review process and assure that both the ambient standards and the increments are protected. Once projects are up and running MDEQ will also require ambient monitoring data from appropriately sited monitors to verify the permit analysis projections and provide a feedback loop of current ambient data to make sure that future permitting decisions continue to protect the standards and increments. MDEQ can and will require ambient monitoring as a permit condition for major sources.

Additionally, much of the permit analysis for sources of this nature requires good ambient data to accurately predict project impacts. Permitting sources of NO_2 and Ozone (O_3-) precursors (VOCs)~~)~~, requires representative monitoring data to adequately analyze the expected impact of new emissions. Prediction of NO_2 is highly dependant on some knowledge of NO to NO_2 conversion rates. This information is supposed to come from either an analysis of actual NO/NO_2 ratios determined by monitoring results (preferred method), the use of a default value (very conservative and has recently resulted in predicted violations of the annual standard), or by the use of ambient Ozone data to predict conversion rates. Permitting large VOC sources raises similar questions. Ozone analysis requires at least some knowledge of atmospheric chemistry conversion rates in the area of analysis. At this time MDEQ does not have reliable data on the actual chemistry that is occurring in the development area and doesn't have any reliable background Ozone values.

Therefore, MDEQ will need NO/NO_2, O_3 and PM data for the development area from a regionally scaled ambient monitoring station. MDEQ has reviewed the modeling done for the EIS and a monitor sited in the Birney/Ashland area would be the best choice. Provided that funds become available, MDEQ would establish and maintain a monitoring station in this area.

It is important that monitors be deployed before CBM development occurs, or as early in the development cycle as possible, in order to provide baseline information and trend data.

3.0 Regulatory Framework

The National and Montana ambient air quality standards set the absolute upper limits for specific air pollutant concentrations at all locations where the public has access. The analysis of the proposed Alternatives must demonstrate continued compliance with all applicable local, state, tribal and federal air quality standards. Existing air quality throughout most of the CBM emphasis area is in attainment with all ambient air quality standards, as demonstrated by the relatively low concentration levels presented in Table AQ-1. However, three areas have been designated as federal nonattainment areas where the applicable standards have been violated in the past: Lame Deer (PM_{10} - moderate) and Laurel (sulfur dioxide (SO_2) - primary), Montana; and Sheridan, Wyoming (PM_{10} - moderate). Specific monitoring data collected by the Northern Cheyenne Tribe are presented in Table AQ-2.

Air quality regulations require certain proposed new, or modified existing, air pollutant emission sources (including CBM compression facilities) to undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees and control devices, prior to construction and/or operation. In addition, the U.S. Congress (through the CAA Section 116) authorized local, state and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. Also, under FLPMA and the CAA, BLM cannot authorize any activity which would not conform to all applicable local, state, tribal and federal air quality laws, regulations, standards, and implementation plans.

Given most the CBM emphasis area's current attainment status, future development projects which have the potential to emit more than 250 tons per year of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tons per year) would be required to undergo a site-specific regulatory PSD Increment Consumption analysis under the federal New Source Review and permitting regulations. Development projects subject to the PSD regulations may also be required by the applicable air quality regulatory agencies to incorporate additional emission control measures (including a BACT analysis and determination) to ensure protection of air quality resources, and demonstrate that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO_2, PM_{10}, and SO_2.

The NEPA analysis compares potential air quality impacts from the proposed alternatives to applicable ambient air quality standards and PSD increments, but comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern for potential impacts, and do not represent a regulatory PSD Increment Consumption Analysis. Even though most of the development activities would occur within areas designated PSD Class II, the potential impacts on regional Class I areas are to be evaluated. The Montana DEQ will perform the required regulatory PSD increment analysis during the new sources review process. This formal regulatory process will include analysis of impacts on Class I and II air quality areas by existing and proposed emission sources. The activities are not allowed to cause incremental effects greater than the stringent Class I thresholds to occur inside any PSD Class I Area. Stringent emission controls (BACT – Best Available Control Technology) and emission limits may be stipulated in air quality permits as a result of this review, or a permit could be denied.

Sources subject to the PSD permit review procedure are also required to demonstrate potential impacts to air quality related values (AQRV). These include visibility impacts, degradation of mountain lakes from atmospheric deposition (acid rain), and effects on sensitive flora and fauna in the Class I areas. The CAA also provides specific visibility protection procedures for the mandatory federal Class I areas designated by the U.S. Congress on August 7, 1977, which included wilderness areas greater than 5,000 acres in size, and national parks and national memorial parks greater than 6,000 acres in size as of that date. The Fort Peck and Northern Cheyenne tribes have also designated their lands as PSD Class I, although the national visibility regulations do not apply in these areas. The allowable incremental impacts for NO_2, PM_{10}, and SO_2 within these PSD Class I areas are very limited. The remainder of the CBM emphasis area is designated PSD Class II with less stringent requirements.

TABLE AQ-2
AMBIENT AIR QUALITY MONITORING DATA COLLECTED BY THE NORTHERN CHEYENNE TRIBE (IN (μG/M^3)

Pollutant	Averaging Time [a]	Year	Morningstar	Garfield Peak	Badger Peak	Lame Deer # 1	Lame Deer # 2	Lame Deer # 3	Lame Deer "PM10A"	Lame Deer "TEOM"
nitrogen dioxide	Annual	1996	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1997	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1998	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1999	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		2000	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
PM_{10}	Annual	1996	6	N/A	N/A	20	N/A	N/A	N/A	N/A
		1997	N/A	N/A	N/A	18	26	N/A	N/A	N/A
		1998	N/A	N/A	N/A	23	32	32	N/A	N/A
		1999	N/A	N/A	N/A	19	33	32	[22] [b]	32 [b]
		2000	N/A	N/A	N/A	18	29	N/A	17 [b]	28 [b]
		2001	N/A	N/A	N/A	16	36	N/A	N/A	N/A
	24-hours	1996	19	N/A	N/A	120	N/A	N/A	N/A	N/A
		1997	N/A	N/A	N/A	106	75	N/A	N/A	N/A
		1998	N/A	N/A	N/A	55	**153**	**153**	N/A	N/A
		1999	N/A	N/A	N/A	41	106	107	[36] [b]	93 [b]
		2000	N/A	N/A	N/A	40	124	N/A	39 [b]	93 [b]
		2001	N/A	N/A	N/A	33	135	N/A	N/A	N/A

TABLE AQ-2
AMBIENT AIR QUALITY MONITORING DATA COLLECTED BY THE NORTHERN CHEYENNE TRIBE (IN (μG/M^3)

Pollutant	Averaging Time [a]	Year	Morningstar	Garfield Peak	Badger Peak	Lame Deer # 1	Lame Deer # 2	Lame Deer # 3	Lame Deer "PM10A"	Lame Deer "TEOM"
sulfur dioxide	Annual	1996	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
		1997	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
		1998	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
		1999	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
		2000	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
	24-hours	1996	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1997	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1998	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1999	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		2000	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
	3-hours	1996	5.2	7.8	5.2	N/A	N/A	N/A	N/A	N/A
		1997	5.2	7.8	5.2	N/A	N/A	N/A	N/A	N/A
		1998	10.4	10.4	10.4	N/A	N/A	N/A	N/A	N/A
		1999	7.8	7.8	5.2	N/A	N/A	N/A	N/A	N/A
		2000	5.2	5.2	5.2	N/A	N/A	N/A	N/A	N/A

Source: EPA (2002b)

Notes: $\mu g/m^3$ - micrograms per cubic meter
N/A - data not available
[a] Short-term averages are reported as the second maximum values.
[b] Supplemental data provided by (Littlewolf 2002).

[data] - data in brackets are not reliable due to the small number of samples collected.

4.0 Agency Roles and Authorities

4.1 Environmental Protection Agency

The Environmental Protection Agency (EPA) administers the Federal Clean Air Act (CAA), (42 U.S.C. 7401 et seq.) to maintain the National Ambient Air Quality Standards (NAAQS) that protect human health and to preserve the rural air quality in the region by assuring the Prevention of Significant Deterioration Class I and Class II increments for SO_2, NO_2, and PM_{10}, are not exceeded. EPA has delegated this CAA authority to the States of Montana and Wyoming.

Until the Tribes have an EPA-approved Tribal program, EPA will administer air quality requirements within Indian country. EPA is responsible for assuring that NAAQS are attained and that the Tribally-designated Northern Cheyenne Class I sensitive airshed is protected, as well as the Class II increment limits that apply on the Crow Reservation. EPA will implement an air permitting program for major sources within Indian country, including BACT analysis, where appropriate. At this time, there is no federal minor source permitting program. Therefore, EPA cannot regulate minor sources in Indian country directly unless EPA decides to implement a Federal Implementation Plan (FIP). Mitigation of particulate emissions from unimproved roads in Indian country may be necessary to protect the Class I and Class II PM_{10} increments.

4.2 Montana DEQ

The MDEQ has been delegated Federal Clean Air Act (CAA) authority from the United States Environmental Protection Agency (EPA) to manage the New Source Review—Prevention of Significant Deterioration (PSD) permit program for listed major sources with the potential to emit (PTE) greater than 100 tons per year (tpy) of any regulated pollutant and all other sources with a PTE greater than 250 tpy of any regulated pollutant. Further, the MDEQ, under the Clean Air Act of Montana (MCA 75-2-101 et seq.) and the Administrative Rules of Montana (ARM) administers a minor source air quality permitting program for sources with a PTE greater than 25 tons per year unless otherwise noted in the ARM. This program requires, among other things, that Best Available Control Technology (BACT) apply to regulated air pollutant emission sources. MDEQ also has delegated responsibility to operate an approved ambient air quality monitoring network for the purpose of demonstrating compliance with the National and Montana Ambient Air Quality Standards (NAAQS/ MAAQS).

Currently, the MDEQ imposes a minor source permit limitation on gas compressor engines on a permit-by-permit basis for sources exceeding the Montana minor source permitting threshold (ARM Chapter 17.8, Subchapter 7). Under the authority of ARM 17.8.715, Emission Control Requirements, the MDEQ establishes BACT on a case-by-case basis for natural gas compressor engines, such as those sources indicated for coal bed methane (CBM) development. In general, the Department has required NO_2 emission limits of around 2 grams per brake horsepower hour (g/bhp-hr), a CO emission limit of around 3 g/bhp-hr, and a volatile organic compound (VOC) emission limit of around 1 g/bhp-hr for these sources. Again, as part of the minor source permitting program, Montana applies pollutant specific BACT to compressor engines on a case-by-case basis with limits as described above. However, should future regulatory modeling indicate potential NAAQS/MAAQS or increment consumption exceedances, the MDEQ may require more stringent limits to protect applicable standards.

In addition to the applicable point source BACT emission limits described above, under the authority of ARM 17.8.308, the MDEQ requires that a permitted source use reasonable precautions to limit fugitive particulate emissions from haul roads, access roads, parking lots, or the general plant property. In general, the MDEQ requires that a source have fresh water and/or chemical dust suppressant available on site and used as necessary to maintain compliance with applicable limits, including, but not limited to, the reasonable precautions and opacity limits. Further, the MDEQ could establish more stringent BACT limits for permitted sources and require that counties apply BACM to unimproved roads or other control measures sufficient to avoid exceeding applicable standards and the Class I and Class II increment limits for PM_{10}. Further, the ARM establishes generally applicable air quality rules pertaining to all sources of air pollution, including sources not subject to air quality permitting. These rules include, but are not limited to, the requirements contained in ARM 17.8, Subchapter 1 and ARM 17.8, Subchapter 3.

4.3 Bureau of Indian Affairs

BIA is responsible for approval of any lease, agreement, permit, or document that could encumber lands and minerals owned by either Tribes or allottees. Under the Indian Mineral Development Act (IMDA), the Secretary of Interior is responsible, based upon BIA recommendation, for approving any contractual arrangement to develop CBM resources. Specific discussion of tribal air quality management issues are addressed separately.

4.4 Bureau of Land Management

NEPA requires that federal agencies consider mitigation of direct and cumulative impacts during their preparation of an EIS. (BLM Land Use Planning Manual 1601.) Under the CAA, federal agencies are to comply with State Implementation Plans regarding the control and abatement of air pollution. Prior to approval of Resource Management Plans (RMPs) or Amendments to RMPs, the State Director is to submit any known inconsistencies with State Implementation Plan (SIP) to the Governor of that state. If the Governor of the State recommends changes in the proposed RMP or Amendment to meet SIP requirements, the State Director shall provide the public an opportunity to comment on those recommendations. (BLM Land Use Planning Manual at Section 1610.3-2.)

4.5 Forest Service

The Forest Service administers nine wilderness areas (WAs) that could be affected by direct effects associated with project and non-project sources: Bridger WA; Fitzpatrick WA; North Absaroka, Absaroka-Beartooth, and Washakie WAs, next to Yellowstone NP; Teton WA; U.L. Bend WA; Cloud Peak WA; and Popo Agie WA with mandatory Class I designation. As federal land mangers, the Forest Service could act in a consultative role to stipulate that the BLM modeling results, or any future EPA or State-administered PSD refined modeling results (if justified), triggers adverse impairment status. Should the Forest Service determine impairment of WAs, then BLM, the State, and/or EPA may need to mitigate this predicted adverse air quality effect.

4.6 National Park Service

Three areas administered by the National Park Service—Yellowstone National Park, Devils Tower National Monument, and Bighorn Canyon National Recreation Area—could be affected by direct effects associated with project and non-project sources. (Note: Additional Park Service Class I and II areas may be impacted by the non-project sources evaluated, without significant impact from project sources.) As federal land mangers, the Park Service could act in a consultative role to stipulate that the BLM modeling results, or any future EPA or State-administered PSD refined modeling results (if justified), triggers adverse impairment status. Should the Park Service determine impairment of NPS-administered Class I areas, then BLM, the State, and/or EPA may need to mitigate this predicted adverse air quality effect.

5.0 Air Quality Management on Tribal Lands

The 1990 Clean Air Act (CAA) Amendments (Section 301(d)) provided tribes the authority to implement CAA programs for their reservations. The Tribal Authority Rule (TAR), promulgated February 12, 1998, reiterates that tribes have direct implementation authority for the CAA. However, until such time as the tribe assumes such responsibility to implement its own program, EPA must implement Federal air quality laws for them. The TAR also requires under §49.11 that EPA promulgate a Federal Implementation Plan (FIP) as necessary or appropriate to protect air quality on the reservations.

EPA has the authority to implement two permitting programs and three source specific programs. EPA has regulatory authority to issue pre-construction permits to major air pollution emissions sources under the Prevention of Significant Deterioration (PSD) program at 40 CFR part 52 and operating permits to major sources under the Title V program at 40 CFR part 71. The PSD program requires that subject sources conduct an air quality analysis to determine the impact on the National Ambient Air Quality Standards (NAAQS) and the PSD increments for NO_2, SO_2, and PM_{10} for three different area classifications (Class I, Class II, and Class III). Under the PSD program, Class I status was assigned to pristine areas, such as national parks and forest lands. Several tribes have been redesignated from a Class II status to a Class I status. The rest of the country is Class II and there are no Class III areas. EPA also has regulatory authority to implement the New Source Performance Standards (NSPS) at 40 CFR part 60, the National Emission Standards for Hazardous Air Pollutants (NESHAP) at 40 CFR part 61, and the Maximum Achievable Control Technology (MACT) standards at 40 CFR part 63.

EPA does not have a rule for a minor source pre-construction permitting program for permitting new and modified sources. A minor source rule is being addressed by the Agency, but such a rule will not be final for 2-3 years. A minor source rule could give EPA the authority to implement a minor source Best Available Control Technology (BACT) requirement for engines. Nor does EPA have a FIP in place for Indian country to address measures for controlling fugitive dust or control technologies for engines.

In 1977, the Northern Cheyenne Indian Tribe's Reservation was redesignated as a Class I airshed under the PSD program. The Tribe has implemented an air quality monitoring program, delivering air quality data to AIRS-AQS since 1981. Currently, the Tribe does not have any EPA approved CAA programs for issuing permits, nor is there a Tribal Implementation Plan (TIP) with general source or source specific requirements or any of the federal NSPS, MACT, or NESHAP standards. At this time, if permitting of major air pollution sources was required, EPA would be the permitting authority.

The Crow Indian Reservation is a Class II airshed. Currently, the Tribe does not have any EPA approved CAA programs for issuing permits, nor is there a TIP with general source or source specific requirements, or any of the federal NSPS, MACT, or NESHAP standards. The Tribe was approved for a CAA Section 103 grant in 2001 to conduct an emissions inventory of the sources on the Reservation. The Tribe is not currently implementing an air quality monitoring program. At this time, if permitting of major air pollution sources were required, EPA would be the permitting authority.

The preferred method to determine the mitigation required to prevent exceedances of ambient air quality standards and to prevent significant deterioration is modeling. EPA will work with the states of Wyoming and Montana along with the tribes to see that, wherever possible, tribal air quality issues are addressed in regional modeling efforts related to coal bed methane development. Additional modeling efforts addressing specific tribal concerns, as necessary, can be undertaken by EPA and the tribal air quality agencies.

Ambient air monitoring can be used to augment and validate modeled results. The Northern Cheyenne Tribe currently conducts ambient air PM_{10} and particulate matter with an aerodynamic diameter equal to or less than 2.5 microns ($PM_{2.5}$) monitoring in the Lame Deer PM_{10} non-attainment area on the Northern Cheyenne Reservation. In order to track the impacts of nearby industrial activities on air quality, the tribe also conducts IMPROVE protocol speciated $PM_{2.5}$ monitoring at the Morningstar site, and PM_{10}, SO_2 and NO_2 monitoring at the Morningstar, Badger Peak and Garfield Peak monitoring stations. These monitoring stations also have collocated meteorological monitors. With updates to emission inventories as a result of coal bed methane development on or outside the Northern Cheyenne Reservation, the monitoring network may need revision or augmentation.

The Crow Tribe does not currently have an air monitoring program and has never had one that submitted data to AIRS-AQS. The Crow tribe has the same rights and potential capabilities as the Northern Cheyenne Tribe. If regional emission increases are sufficient to threaten the NAAQS or other relevant air quality standard on Crow lands, EPA would work with the tribe to encourage them to initiate monitoring activities. To this end, the Tribe can build the capability necessary to conduct ambient air quality monitoring. In the event the tribe chooses not to conduct monitoring, EPA can choose to conduct monitoring using either EPA personnel or contract assistance under Section 301 of the Clean Air Act.

In addition to point source emissions, fugitive dust controls for coal bed methane sources will likely be needed for development on tribal lands. The Tribes can use contractual relationships with developers to require necessary construction phase dust controls on wells on Tribal lands. EPA will work with Tribal, BIA and county agencies as needed to develop and implement necessary mitigation on unpaved roads used for development related traffic.

6.0 Air Quality Impact Assessment

As described in **Chapter 4, Environmental Consequences (Air Quality)**, an extensive air quality impact assessment technical support document was prepared by Argonne National Laboratory (Argonne 2002) and is available for review. Argonne analyzed potential impacts from: individual proposed Alternatives A, B/C/E, and D (project sources); "Non-project" emission sources (existing sources, RFFA and Wyoming PRBO&G Alternative 1; RFFA emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest; and all sources cumulatively by Alternative. Since Alternatives B, C and E have very similar emission inventories, a single air quality impact analysis represents all of these three Alternatives. For example, under Alternative C the number of wells connected to a field (booster) compressor would not be limited but the number was assumed to be the same as in Alternative B, and under Alternative E electrical field (booster) compressors would be required where noise is an issue although all compressors were assumed to be gas-fired.

The air quality impact assessment was based on the best available engineering data and assumptions, meteorology data, and dispersion modeling procedures, as well as professional and scientific judgment. However, where specific data or procedures were not available, reasonable assumptions were made. Note that these assumptions could result in under or over-estimates of impacts. It is difficult to ascertain the overall bias of the emission estimates and modeling; no sensitivity or probabilities of occurrence analyses were performed.

Air quality impacts for various air pollutants are determined by the use of air dispersion models using specific source emission rates. For natural gas compressors, the emissions of nitrogen oxides are determined by the assumed permitted emission rate allowed by the state. For fugitive dust impacts, emission rates are obtained from EPA's AP-42 document that is titled "Compilation of Air Pollutant Emission Factors". An AP-42 emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. Emission factors may be appropriate to use in a number of situations such as making source-specific emission estimates for area-wide inventories. These inventories have many purposes including ambient dispersion modeling and analysis, control strategy development, and in screening sources for compliance investigations. In most cases, these factors are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all sources in a specific category.

Potential air pollutant emissions from the proposed Alternatives emission sources (denoted as "project" sources) were calculated separately to determine potential impacts. These emissions were then combined with existing sources, proposed non-PRBO&G developments and reasonably foreseeable future actions (RFFA) emissions (denoted as "non-project" sources) and RFFA emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest to determine the total potential cumulative air quality impacts. All of the tables in this Air Quality Modeling Appendix display impacts from: 1) the project sources only; 2) the project sources combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest (denoted as "Project + RFFA Sources); 3) the non-project sources; and 4) cumulative totals.

The non-project sources include development permitted: 1) by the MDEQ; 2) by the WYDEQ; and 3) within the states of North Dakota, South Dakota, and Nebraska; and projections for the Wyoming Powder River Basin Oil and Gas Project DEIS Alternative sources (BLM 2002a); and other RFFA sources from states within the geographic area covered by the model.

Potential direct, indirect and cumulative air quality impacts were analyzed and reported solely under the requirements of NEPA, in order to assess and disclose reasonably foreseeable impacts to both the public and the BLM decision maker before a Record of Decision is issued. Due to the preliminary nature of this NEPA analysis, it should be considered a reasonable estimate of predicted impacts. Actual impacts at the time of development (subject to air pollutant emission source permitting) could be different. To the extent that impacts are predicted to be greater than regulatory thresholds, appropriate mitigation efforts would be undertaken.

Given the lack of representative wind measurements throughout the CBM emphasis area, the EPA CALPUFF dispersion model was used with regional wind speed and direction values derived from the 1996 MM5 (mesoscale model) and CALMET meteorological models (Argonne 2002). Meteorological information was assembled to characterize atmospheric transport and dispersion from several 1996 data sources, including: 36 km gridded MM5 (mesoscale model) values with continuous four-dimensional data assimilation; and hourly surface observations (wind speed, wind direction, temperature, cloud cover, ceiling height, surface pressure, relative humidity, and precipitation.)

Potential air quality impacts were predicted using the EPA CALPUFF dispersion model. The meteorology data and air pollutant emission values were combined to predict maximum potential direct, indirect, and cumulative near-field air quality impacts in the vicinity of assumed well and compressor engine emission sources for comparison with applicable air quality standards and PSD Class II increments. Maximum potential near-field particulate matter emissions from traffic on unpaved roads and during well pad construction were used to predict the maximum annual and 24-hour average $PM_{2.5}$, PM_{10}, and SO_2 impacts. Maximum air pollutant emissions from each CBM well would be temporary (i.e., occurring during a 12-day construction period) and would occur in isolation, without significantly interacting with adjacent well locations. Particulate matter emissions from well pad and resource road construction would be minimized by application of water and/or chemical dust suppressants. The control efficiency of these dust suppressants was computed at 50 per cent during construction. During well completion testing, natural gas could be burned (flared) up to 24 hours.

Air pollutant dispersion modeling was also performed to quantify CO, NO_2, $PM_{2.5}$, PM_{10}, and HAP impacts during operation. Operation emissions would primarily occur due to increased compression requirements, including field (booster) and sales (pipeline) compressor stations. Since produced natural gas is nearly pure methane, with little or no liquid hydrocarbons or sulfur compounds, direct VOC emissions or objectionable odors are not likely to occur. HAP impacts were predicted based on an assumed 9,900 horsepower, six-unit, reciprocating compressor engine station operating at full load with emissions generated by a single stack.

The significance criteria for potential air quality impacts include local, state, tribal and federally enforced legal requirements to ensure air pollutant concentrations will remain within specific allowable levels. These requirements and legal limits were presented in Table AQ-1. Where legal limits have not been established, the BLM uses the best available scientific information to identify thresholds of significant adverse impacts. Thresholds have been identified for hazardous air pollutant (HAP) exposure, potential acid neutralizing capacity (ANC) changes to sensitive lake water chemistry, and a 1.0 dv "just noticeable change" in potential visibility impacts.

Since neither the MDEQ nor EPA have established HAP standards, predicted 8-hour HAP concentrations were compared to a range of 8-hour state maximum Acceptable Ambient Concentration Levels (EPA 1997a). Pollutants which were predicted to exceed these state threshold levels were also analyzed to determine the possible incremental cancer-risk for a most likely exposure (MLE) to residents, and to a maximally exposed individual (MEI), such as compressor station workers. These cancer risks were calculated based on the maximum predicted annual concentrations, EPA's unit risk factors for carcinogenic compounds (EPA 1997b), and an adjustment for time spent at home or on the job.

The EPA CALPUFF dispersion model was also used to determine maximum far-field ambient air quality impacts at downwind mandatory federal PSD Class I areas, and other sensitive receptors, to: 1) determine if the PSD Class I increments might be exceeded; 2) calculate potential total sulfur and nitrogen deposition, and their related impacts to in sensitive lakes; and 3) predict potential visibility impacts (regional haze) within distant sensitive receptors.

Several lakes within five FS designated wilderness areas were identified as being sensitive to atmospheric deposition and for which the most recent and complete data have been collected. The FS (Fox et al. 1989) has identified the following total deposition (wet plus dry) thresholds below which no adverse impacts are likely: five kg/ha-yr for sulfur, and three kg/ha-yr for nitrogen. The FS (2000) has also developed a screening method which identifies the following Limit of Acceptable Change regarding potential changes in lake chemistry: no more than a ten per cent change in ANC for those water bodies where the existing ANC is at or above 25 μeq/l, and no more than a one μeq/l change for those extremely sensitive water bodies where the existing ANC is below 25 μeq/l. No sensitive lakes were identified by either the NPS or FWS.

Since the potential air pollutant emission sources constitute many small sources spread out over a very large area, discrete visible plumes are not likely to impact the distant sensitive areas, but the potential for cumulative visibility impacts (increased regional haze) is a concern. Regional haze degradation is caused by fine particles and gases scattering and absorbing light. Potential changes to regional haze are calculated in terms of a perceptible "just noticeable change" (1.0 dv) in visibility when compared to background conditions. A 1.0 dv change is considered potentially significant in mandatory federal PSD Class I areas as described in the EPA Regional Haze Regulations (40 CFR 51.300 et seq.), and as originally presented in Pitchford and Malm (1994). A 1.0 dv change is defined as about a ten per cent change in the extinction coefficient (corresponding to a two to five per cent change in contrast, for black target against a clear sky, at the most optically sensitive distance from an observer), which is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory federal Class I areas.

It should be noted that a 1.0 dv change is not a "just noticeable change" in all cases for all scenes. Visibility changes less than 1.0 dv are likely to be perceptible in some cases, especially where the scene being viewed is highly sensitive to small amounts of pollution, such as due to preferential forward light scattering. Under other view-specific conditions, such as where the sight path to a scenic feature is less than the maximum visual range, a change greater than 1.0 dv might be required to be a "just noticeable change." However, this NEPA analysis is not designed to predict specific visibility impacts for specific views in specific mandatory federal PSD Class I areas based on specific project designs, but to characterize reasonably foreseeable visibility conditions that are representative of a fairly broad geographic region, based on reasonable emission source assumptions. This approach is consistent with both the nature of regional haze and the requirements of NEPA. At the time of a pre-construction air quality permit review, the applicable air quality regulatory agency may require a much more detailed visibility impact analysis. Factors such as the magnitude of change, frequency, time of the year, and the meteorological conditions during times when predicted visibility impacts are above the 1.0 dv threshold (as well as inherent conservatism in the modeling analyses) should all be considered when assessing the significance of predicted impacts.

The FS, NPS and FWS have published their "Final FLAG Phase I Report" (Federal Register, Vol. 66 No. 2, dated January 3, 2001), providing "a consistent and predictable process for assessing the impacts of new and existing sources on AQRVs" including visibility. For example, the FLAG report states "A cumulative effects analysis of new growth (defined as all PSD increment-consuming sources) on visibility impairment should be performed," and further, "If the visibility impairment from the proposed action, in combination with cumulative new source growth, is less than a change in extinction of 10% [1.0 dv] for all time periods, the Federal Land Managers (FLM) will not likely object to the proposed action."

The FLAG report also recommends a two-step analysis process to evaluate potential visibility impacts from either a single proposed air pollutant emission source (the seasonal FLAG screening method) or potential cumulative visibility impacts from a group of air pollutant emission sources (the daily FLAG refined method). As described in Argonne (2002), this NEPA analysis first used the seasonal FLAG screening method (based on both the FLAG and WYDEQ-AQD "natural background" reference levels) to exclude those sensitive areas where visibility impacts were not likely to occur. Since no areas were excluded using the seasonal FLAG screening method, this NEPA analysis then applied the daily FLAG refined method (based on hourly background optical extinction and relative humidity values measured in both the Badlands and Bridger wilderness areas between 1989 and 1999) to determine the average number of days a 1.0 dv "just noticeable change" would be reached annually in each sensitive area. Although the use of observed hourly optical extinction and relative humidity values is appropriate in this NEPA analysis (where the potential visibility impacts are predicted to occur under the Alternatives based on the reasonably foreseeable background conditions), EPA's Regional Haze Regulations are based on optical conditions reconstructed from $PM_{2.5}$ and PM_{10} data collected every third day under the IMPROVE program.

7.0 Modeling Assumptions

When reviewing the predicted near- and far-field air quality impacts, it is important to understand that assumptions were made regarding development, emissions, meteorology, atmospheric transport and chemistry, and atmospheric deposition. For example, there is uncertainty regarding ultimate development (i.e., number of wells, equipment to be used, specific locations of wells, etc.).

The following assumptions were used in the analysis:

- Total predicted short-term air pollutant impact concentrations were assumed to be the sum of the assumed background concentration, plus the predicted maximum cumulative modeled concentrations, which may occur under different meteorological conditions.
- Assumed background air pollution concentrations were assumed to occur throughout the 20-year life of project (LOP) at all locations in the region, even though monitoring is primarily conducted in urban or industrial areas, rather than rural areas. The uniform background PM_{10} levels for each state are assumed to be representative of the background conditions for the entire modeled area of the PRB, based on monitoring data gathered throughout northeastern Wyoming and southeastern Montana.
- The maximum predicted air quality impacts occur only in the vicinity of the anticipated emission sources. Actual impacts would likely be less at distances beyond the predicted points of maximum impact.
- All emission sources were assumed to operate at their reasonably foreseeable maximum emission rates simultaneously throughout the LOP. Given the number of sources included in this analysis, the probability of such a scenario actually occurring over an entire year is small.
- In developing the emissions inventory and model, there is uncertainty regarding ultimate development (i.e., number of wells, equipment to be used, specific locations, etc.) Most (90 per cent) proposed CBM wells and 30 per cent of conventional wells were assumed to be fully operational and remain operating (no shut ins) throughout the LOP.
- The total proposed booster (field) and pipeline (sales) compression engines were assumed to operate at their rated capacities continuously throughout the LOP (no phased increases or

reductions). In reality, compression equipment would be added or removed incrementally as required by the well field operation, compressor engines would operate below full horsepower ratings, and it is unlikely all compressor stations would operate at maximum levels simultaneously.

- The HAP analyses assumed a six-unit, 1,650 hp each, reciprocating compressor engine station would operate at full load and at maximum emission levels continuously throughout the LOP.

- The emissions inventory and model use peak years of construction and peak years of operations, which would not occur throughout the entire development region at the same time. However, these conditions may occur in some areas.

- The emissions inventory and model assumed that a reasonably foreseeable emission rate for compressor engines of 1.5 g/hp-hr of nitrogen oxides (NO_x)is achievable in Montana. Since BACT is decided on a case-by-case basis, actual emission rates could be decided to be less or more than this level by the Departments of Environmental Quality in Montana or Wyoming, and on Indian lands by EPA, for field and sales compressor engines. Reasonable NO_x emission rates may range from 0.7 to 2 g/hp-hr.

- There are no applicable local, state, tribal or federal acid deposition standards. In the absence of applicable standards, the acid deposition analysis assumed that a “limit of acceptable change” is: a 10 per cent change in acid neutralizing capacity (ANC) for lakes with a background ANC greater than 25 μeq/l; or a 1 μeq/l change in ANC for lakes with a background ANC less than 25 μeq/l, and would be a reasonably foreseeable significant adverse impact. Further, the atmospheric deposition impact analysis assumed no other ecosystem components would affect lake chemistry for a full year (assuming no chemical buffering due to interaction with vegetation or soil materials).

- The visibility impact analysis assumed that a 1.0 dv “just noticeable change” would be a reasonably foreseeable significant adverse impact, although there are no applicable local, state, tribal or federal regulatory visibility standards. However, some FLMs are using 0.5 dv as a screening threshold for significance.

- Mitigation measures are included in the emissions inventory and model that may not be achievable in all circumstances. However, actual mitigation decided by the developers and local and state authorities may be greater or less than those assumed in the analysis. For example, maintaining a construction road speed limit of 15 mph may be reasonable in a construction zone but difficult to enforce elsewhere. Full (100%) mitigation of fugitive dust from disturbed lands may not be achievable. Further, 50% reduction in fugitive emissions is assumed based on construction road wetting on the unimproved access road to the pad and at the pad, but this level of effectiveness is characterized as the maximum possible. In the air quality modeling, no specific road wetting or other emissions controls were assumed to be used during the operations phase of the development (e.g., for maintenance vehicle traffic). However, during the review of proposed projects (Applications for Permit to Drill) the BLM would require specific mitigation measures in certain areas during the operational phase of development.

- Induced or secondary growth related to increases in vehicle miles traveled (VMT) (believed to be on the order of 10 per cent overall) is not included in the emissions inventory and model. Not all fugitive dust emissions (including county and other collector roads) have been included in the emissions inventory and model.

- Fugitive dust emissions from roads are treated as area sources rather than line sources in the model, which may thereby reduce or increase the predicted ambient concentrations at maximum concentration receptor points near the source, depending on the inputs to the model (meteorology, terrain, etc.) By not placing modeled receptors close to emission sources (e.g. wells and roads), the model may not capture higher ambient concentrations near these sources. A more refined, regulatory model may yield higher concentrations at locations near fugitive dust sources.

- For comparisons to the PSD Class I and II increments, the emissions inventory and model included only CBM and RFFA sources. Other existing increment consuming sources such as Campbell County, Wyoming coal mines were not included in this comparison, as the air quality analysis does not represent a regulatory PSD increment consumption analysis. A regulatory PSD increment consumption analysis needs to identify and consider all PSD increment consuming sources to determine the level of PSD Class II increment consumption. Monitoring data in Wyoming has indicated an upward trend in PM concentrations in Campbell County since 1999, which coincides with CBM development but is also exacerbated by prolonged drought in the region.

It is important to note that before actual development could occur, the applicable air quality regulatory agencies (including the state, tribe or EPA) would review specific air pollutant emissions pre-construction permit applications that examine potential project-specific air quality impacts for some source categories. As part of these permit reviews (depending on source size), the air quality regulatory agencies could require additional air quality impact analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses would be performed to ensure protection of air quality.

8.0 Modeling Results

The following Tables present the detailed atmospheric dispersion modeling results which are summarized in **Chapter 4, Environmental Consequences (Air Quality)**.

TABLE AQ-3
PREDICTED HAZARDOUS AIR POLLUTANT IMPACTS AND SIGNIFICANCE THRESHOLDS (IN (μG/M^3)

Pollutant	Averaging Time	Direct Modeled Impact	Range of State Acceptable Ambient Concentration Levels
formaldehyde	8-hours	**11.9**	**4.5** (FL07) - 71 (NV01)
n-hexane	8-hours	0.6	1,800 (FL07) - 36,000 (CT01)
benzene	8-hours	0.7	30 (FL04) - 714 (NV01)
toluene	8-hours	4.6	1,870 (IN03) - 8,930 (NV01)
ethyl benzene	8-hours	< 0.1	4,340 (ND01) - 43,500 (VT01)
xylene	8-hours	0.2	2,170 (IN01) - 10,400 (NV01)

Source: Argonne (2002)

Agencies: CT01 - Connecticut Department of Environmental Protection; Air Compliance Unit
FL04 - Broward County Department of Natural Resource Protection (Florida)
FL07 - Pinellas County Air Pollution Control Board (Florida)
IN01 - Indiana Department of Environmental Management
IN03 - Indianapolis Air Pollution Control Division (Indiana)
ND01 - North Dakota Dept. of Health; Division of Environmental Engineering
NV01 - Nevada Division of Environmental Protection; Air Quality Control
VT01 - Vermont Dept. of Environmental Conservation; Air Pollution Control Division

TABLE AQ-4
ALTERNATIVE A—PREDICTED CRITERIA POLLUTANT IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS (IN (μG/M^3)

Pollutant	Avg Time [a]	Location	PSD Increment	Alt A Project	Non-Project	Cum	Background	Total	NAAQS	MAAQS
carbon monoxide	1-hour	near-field	- - -	49	540	540	15,000	15,540	40,000	26,000
		far-field [1]	- - -	1	100	100	15,000	15,100	40,000	26,000
	8-hours	near-field	- - -	30	311	314	6,600	6,914	10,000	10,000
		far-field [1]	- - -	<1	52	52	6,600	6,652	10,000	10,000
nitrogen dioxide	1-hour	near-field	- - -	21	181	187	117	304	- - -	566
		far-field [1]	- - -	2.0	36	36	117	153	- - -	566
	Annual	near-field	25	1.9	4.8	6.0	11	17	100	100
		far-field [3]	25	1.2	1.1	2.0	11	13	100	100
		far-field [2]	2.5	0.2	0.5	0.7	11	12	100	100
$PM_{2.5}$	24-hours	near-field	- - -	1.0	44.1	44.4	20	64	65	- - -
		far-field [4]	- - -	0.1	12.7	12.7	20	33	65	- - -
	Annual	near-field	- - -	0.3	5.6	5.8	8	14	15	- - -
		far-field [4]	- - -	0.0	1.2	1.2	8	9	15	- - -
PM_{10}	24-hours	near-field	**30** [b]	1.8	**104** [b]	**105** [b]	105	**210** [c]	**150** [c]	**150** [c]
		far-field [4]	30	0.1	29.7	29.7	105	135	150	150
		far-field [2]	**8** [b]	0.5	**8.4** [b]	**8.7** [b]	105	114	150	150
		far-field [5]	8	0.2	7.2	7.4	105	112	150	150
	Annual	near-field	17	0.5	13.1	13.4	30	43	50	50
		far-field [4]	17	0.0	2.7	2.7	30	33	50	50
sulfur dioxide	1-hour	near-field	- - -	1.9	27.4	28.0	666	694	- - -	1,300
		far-field [3]	- - -	1.2	29.6	29.6	666	696	- - -	1,300
	3-hours	near-field	512	1.5	22.6	23.3	291	314	1,300	- - -
		far-field [3]	512	1.0	17.1	17.1	291	308	1,300	- - -
	24-hours	near-field	91	0.9	9.8	10.2	73	83	365	260
		far-field [3]	91	0.6	5.3	5.3	73	78	365	260
	Annual	near-field	20	0.3	1.0	1.1	16	17	80	60
		far-field [3]	20	0.2	0.4	0.4	16	16	80	60

Source: Argonne (2002)

Notes:
[a] Annual impacts are the first maximum value; short-term impacts are the second maximum value. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.
[b] It is possible that Non-Project and **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation, as well as the PSD Class II increment near the maximum assumed development; a regulatory “PSD Increment Consumption Analysis” should be conducted during permitting by the appropriate air quality regulatory agency.
[c] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 105 $\mu g/m^2$ were predicted to exceed the National and Montana ambient air quality standards due to Non-Project and **Cum** emission sources.

Alt A Project - Direct modeled Alternative A project sources impacts.
Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt A**, including the Wyoming “Powder River Basin Oil and Gas Project” DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.
Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alt A** Project and Non-Project impacts, which can occur at different locations.
Total - The sum of the cumulative modeled impact and the assumed background concentration.
NAAQS - Applicable National Ambient Air Quality Standard.
MAAQS - Applicable Montana Ambient Air Quality Standard.

Locations:
1 – Absaroka-Beartooth Wilderness Area
2 – Northern Cheyenne Indian Reservation
3 – Crow Indian Reservation
4 – Fort Belknap Indian Reservation
5 – Washakie Wilderness Area

TABLE AQ-5
ALTERNATIVE A - PREDICTED ATMOSPHERIC DEPOSITION IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS

			Total Sulfur Deposition (kg/ha-yr)				**Total Nitrogen Deposition (kg/ha-yr)**				**Acid Neutralizing Capacity (per cent)**				
Location	**PSD Class**	**Lake**	**Alt A Project**	**Non-Project**	**Cum**	**Thld**	**Alt A Project**	**Non-Project**	**Cum**	**Thld**	**Bkgd (µeq/l)**	**Alt A Project**	**Non-Project**	**Cum**	**Thld**
Bridger WA	I	Black Joe	<0.01	0.01	0.01	5	<0.01	0.03	0.03	3	69.0	0.1	2.2	2.3	10
		Deep	<0.01	0.01	0.01	5	<0.01	0.03	0.03	3	61.0	0.1	2.5	2.6	10
		Hobbs	<0.01	0.01	0.01	5	<0.01	0.02	0.02	3	68.0	<0.1	1.2	1.3	10
		Upper Frozen	<0.01	0.01	0.01	5	<0.01	0.03	0.03	3	5.8	<0.1 [a]	**1.6** [a]	**1.6** [a]	**1** [a]
Fitzpatrick WA	I	Ross	<0.01	0.01	0.01	5	<0.01	0.02	0.02	3	61.4	0.1	1.7	1.7	10
Absaroka-Beartooth WA	II	Stepping Stone	<0.01	0.02	0.02	5	<0.01	0.02	0.03	3	27.0	0.1	2.0	2.1	10
		Twin Island	<0.01	0.01	0.02	5	<0.01	0.02	0.03	3	36.0	0.1	1.4	1.5	10
Cloud Peak WA	II	Emerald	<0.01	0.03	0.03	5	<0.01	0.07	0.08	3	53.3	0.2	4.4	4.6	10
		Florence	<0.01	0.03	0.03	5	<0.01	0.08	0.08	3	32.7	0.3	8.1	8.4	10
Popo Agie WA	II	Lower Saddlebag	<0.01	0.01	0.01	5	<0.01	0.03	0.03	3	55.5	0.1	3.2	3.2	10

Source: Argonne (2002)

Notes: **Alt A** Project - Direct modeled Alternative A impacts.

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt A**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.

Cum – Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alt A Project** and **Non-Project** impacts. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Thld – Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from FS (2000).

WA – Wilderness Area.

a - Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 µeq/l, the applicable significance threshold is less than a 1 µeq/l change. This threshold is exceeded by Non-Project and **Cum** emission sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

TABLE AQ-6
ALTERNATIVE A—DAILY FLAG REFINED METHOD—VISIBILITY IMPACT ANALYSIS
(NUMBER OF DAYS Δ1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alt A Project	Non-Project	Cum
Badlands WA	mandatory federal Class I	0	17 to 25	18 to 25
Bridger WA	mandatory federal Class I	0	8 to 10	8 to 10
Fitzpatrick WA	mandatory federal Class I	0	7 to 9	8 to 10
Gates of the Mountains WA	mandatory federal Class I	0	3 to 4	3 to 4
Grand Teton NP	mandatory federal Class I	0	4 to 6	4 to 6
North Absaroka WA	mandatory federal Class I	0	10 to 12	11 to 12
Red Rock Lakes WA	mandatory federal Class I	0	0 to 1	0 to 1
Scapegoat WA	mandatory federal Class I	0	2 to 2	2 to 3
Teton WA	mandatory federal Class I	0	7 to 9	7 to 10
Theodore Roosevelt NP (North Unit)	mandatory federal Class I	0	1 to 2	1 to 2
Theodore Roosevelt NP (South Unit)	mandatory federal Class I	0	2 to 4	2 to 4
U.L. Bend WA	mandatory federal Class I	0	5 to 5	5 to 6
Washakie WA	mandatory federal Class I	0	11 to 14	12 to 15
Wind Cave NP	mandatory federal Class I	0	21 to 27	22 to 28
Yellowstone NP	mandatory federal Class I	0	9 to 11	9 to 11
Fort Peck IR	Tribal designated Class I	0	1 to 2	2 to 2
Northern Cheyenne IR	Tribal designated Class I	0	30 to 38	33 to 42
Absaroka-Beartooth WA	federal Class II	0	28 to 29	28 to 30
Agate Fossil Beds NM	federal Class II	0	10 to 15	10 to 15
Bighorn Canyon NRA	federal Class II	0	19 to 21	19 to 23
Black Elk WA	federal Class II	0	20 to 26	20 to 26
Cloud Peak WA	federal Class II	0	21 to 28	23 to 30
Crow IR	federal Class II	2	56 to 61	65 to 69
Devils Tower NM	federal Class II	0	24 to 38	26 to 39
Fort Belknap IR	federal Class II	0	60 to 61	61 to 61
Fort Laramie NHS	federal Class II	0	13 to 17	13 to 17

TABLE AQ-6
ALTERNATIVE A—DAILY FLAG REFINED METHOD—VISIBILITY IMPACT ANALYSIS
(NUMBER OF DAYS Δ1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alt A Project	Non-Project	Cum
Jewel Cave NM	federal Class II	0	24 to 31	24 to 32
Mount Rushmore NMem	federal Class II	0	17 to 22	17 to 22
Popo Agie WA	federal Class II	0	8 to 10	8 to 10
Soldier Creek WA	federal Class II	0	13 to 18	13 to 18

Source: Argonne (2002)

Notes: **Alt A** Project - Direct modeled Alternative 1 impacts.

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt A**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS sources. The range of values corresponds to including Wyoming Alternative 3 (low) to Wyoming Alternative 1 (high).

Cum - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct **Alt A** Project and Non-Project impacts, which can occur at different locations. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Locations:

IR - Indian Reservation. **NHS** - National Historic Site. **NM** - National Monument

NMem - National Memorial. **NP** - National Park. **NRA** - National Recreation Area

WA - Wilderness Area.

TABLE AQ-7
ALTERNATIVES B/C/E - PREDICTED CRITERIA POLLUTANT IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS (IN (μG/M^3)

Pollutant	Avg Time [a]	Location	PSD Increment	Alts B/C/E Project	Alts B/C/E Project + RFFA	Non-Project	Cum	Back-ground	Total	NAAQS	MAAQS
carbon monoxide	1-hour	near-field	- - -	109	112.6	540.0	548.2	15,000	15,548	40,000	26,000
		far-field [1]	- - -	6	7.3	100.0	100.0	15,000	15,100	40,000	26,000
	8-hours	near-field	- - -	74	77.2	311.3	337.2	6,600	6,937	10,000	10,000
		far-field [2]	- - -	56	57.8	28.9	78.0	6,600	6,677	10,000	10,000
nitrogen dioxide	1-hour	near-field	- - -	100	102.3	181.0	207.3	117	324.3	- - -	566
		far-field [3]	- - -	58	60.1	27.5	73.3	117	190.3	- - -	566
	Annual	near-field	25	9.1	9.4	4.8	10.7	11	21.7	100	100
		far-field [3]	25	3.9	4.7	1.1	5.4	11	16.4	100	100
		far-field [2]	**2.5**[c]	1.9	**3.7**[c]	0.5	**4.2**[c]	11	15.2	100	100
$PM_{2.5}$	24-hours	near-field	- - -	6.2	6.9	44.1	45.9	20	**65.9** [b]	**65** [b]	- - -
		far-field [3]	- - -	4.2	5.1	10.6	14.7	20	34.7	65	- - -
	Annual	near-field	- - -	1.4	1.5	5.6	6.3	8	14.3	15	- - -
		far-field [3]	- - -	0.7	0.8	0.5	1.2	8	9.2	15	- - -
PM_{10}	24-hours	near-field	**30** [c]	12.1	13.1	**103.8** [c]	**107.1** [c]	105	**212.1** [d]	**150** [d]	**150** [d]
		far-field [4]	30	0.3	0.4	29.7	29.7	105	134.7	150	150
		far-field [2]	**8** [c]	4.2	5.9	**8.4** [c]	**12.8** [c]	105	117.8	150	150
		far-field [5]	**8** [c]	1.4	2.0	7.2	**9.2** [c]	105	114.2	150	150
	Annual	near-field	17	3.6	3.7	13.1	14.3	30	44.3	50	50
		far-field [4]	17	<0.1	<0.1	2.7	2.7	30	32.7	50	50
sulfur dioxide	1-hour	near-field	- - -	4.6	4.6	27.4	28.2	666	694.2	- - -	1,300
		far-field [3]	- - -	2.2	2.2	29.6	29.6	666	695.6	- - -	1,300
	3-hours	near-field	512	3.5	3.5	22.6	23.6	291	314.6	1,300	- - -
		far-field [3]	512	1.7	1.8	17.1	17.1	291	308.1	1,300	- - -
	24-hours	near-field	91	2.1	2.1	9.8	10.5	73	83.5	365	260
		far-field [3]	91	1.0	1.1	5.3	5.3	73	78.3	365	260
	Annual	near-field	20	0.7	0.7	1.0	1.2	16	17.2	80	60
		far-field [3]	20	0.3	0.3	0.4	0.4	16	16.4	80	60

Source: Argonne (2002)

Notes:

[a] Annual impacts are the first maximum value; short-term impacts are the second maximum value. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.
[b] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 20 $\mu g/m^2$ were predicted to exceed the National ambient air quality standards due to **Cum** emission sources.
[c] It is possible that **Alts B/C/E Project + RFFA**, Non-Project and/or **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation and the Washakie Wilderness Area, as well as the PSD Class II increment near the maximum assumed development; a regulatory "PSD Increment Consumption Analysis" should be conducted during permitting by the appropriate air quality regulatory agency.
[d] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 105 $\mu g/m^2$ were predicted to exceed the National and Montana ambient air quality standards due to Non-Project and **Cum** emission sources.

Alts B/C/E Project - Direct modeled Alternatives' B/C/E impacts.
Alts B/C/E Project + RFFA - Direct modeled Alternatives' B/C/E impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.
Non-Project – Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alts B/C/E**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.
Cum – Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alts B/C/E** Project and Non-Project impacts, which can occur at different locations.
Total - The sum of the cumulative modeled impact and the assumed background concentration.
NAAQS – Applicable National Ambient Air Quality Standard.
MAAQS – Applicable Montana Ambient Air Quality Standard.

Locations:
1 – Absaroka-Beartooth Wilderness Area
2 – Northern Cheyenne Indian Reservation
3 – Crow Indian Reservation
4 – Fort Belknap Indian Reservation
5 – Washakie Wilderness Area

TABLE AQ-8
ALTERNATIVES B/C/E - PREDICTED ATMOSPHERIC DEPOSITION IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS

			Total Sulfur Deposition (kg/ha-yr)					Total Nitrogen Deposition (kg/ha-yr)					Acid Neutralizing Capacity (per cent)					
Location	**PSD Class**	**Lake**	**Alts B/C/E Project**	**Alts B/C/E Project + RFFA**	**Non-Project**	**Cum**	**Thld**	**Alts B/C/E Project**	**Alts B/C/E Project + RFFA**	**Non-Project**	**Cum**	**Thld**	**Bkgd (μeq/l)**	**Alts B/C/E Project**	**Alts B/C/E Project + RFFA**	**Non-Project**	**Cum**	**Thld**
Bridger WA	I	Black Joe	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.03	0.03	3	69.0	0.3	0.4	2.2	2.6	10
		Deep	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.03	0.03	3	61.0	0.3	0.4	2.5	2.9	10
		Hobbs	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.02	0.02	3	68.0	0.2	0.3	1.2	1.5	10
		Upper Frozen	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.03	0.03	3	5.8	0.2 [a]	0.25 [a]	**1.6** [a]	**1.8** [a]	**1** [a]
Fitzpatrick WA	I	Ross	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.02	0.02	3	61.4	0.3	0.4	1.7	2.1	10
Absaroka-Beartooth WA	II	Stepping Stone	<0.01	<0.01	0.02	0.02	5	0.01	0.01	0.02	0.03	3	27.0	0.4	0.6	2.0	2.5	10
		Twin Island	<0.01	<0.01	0.01	0.02	5	0.01	0.01	0.02	0.03	3	36.0	0.3	0.4	1.4	1.8	10
Cloud Peak WA	II	Emerald	<0.01	<0.01	0.03	0.03	5	0.02	0.03	0.07	0.10	3	53.3	1.1	1.4	4.4	5.9	10
		Florence	<0.01	<0.01	0.03	0.03	5	0.02	0.03	0.08	0.11	3	32.7	1.7	2.3	8.1	**10.4** [b]	**10** [b]
Popo Agie WA	II	Lower Saddlebag	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.03	0.04	3	55.5	0.3	0.5	3.2	3.6	10

Source: Argonne (2002)

Notes: **Alts B/C/E** Project - Direct modeled Alternatives' B/C/E impacts.

Alts B/C/E Project + RFFA - Direct modeled Alternatives' B/C/E impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alts B/C/E**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alts B/C/E** Project and Non-Project impacts. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Thld - Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from FS (2000).

WA - Wilderness Area.

a - Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 μeq/l, the applicable significance threshold is less than a 1 μeq/l change. This threshold is exceeded by Non-Project and **Cum** emission sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

b – The potential cumulative impact of 10.4 μeq/l change would exceed the threshold level of 10 μeq/l for Florence Lake.

TABLE AQ-9
ALTERNATIVES B/C/E - DAILY FLAG REFINED METHOD - VISIBILITY IMPACT ANALYSIS
(NUMBER OF DAYS Δ1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alts B/C/E Project	Alts B/C/E Project + RFFA	Non-Project	Cum
Badlands WA	mandatory federal Class I	0	0	17 to 25	21 to 28
Bridger WA	mandatory federal Class I	2	3	8 to 10	10 to 12
Fitzpatrick WA	mandatory federal Class I	2	3	7 to 9	10 to 12
Gates of the Mountains WA	mandatory federal Class I	0	0	3 to 4	4 to 4
Grand Teton NP	mandatory federal Class I	0	0	4 to 6	6 to 8
North Absaroka WA	mandatory federal Class I	2	4	10 to 12	13 to 15
Red Rock Lakes WA	mandatory federal Class I	0	0	0 to 1	2 to 3
Scapegoat WA	mandatory federal Class I	0	0	2 to 2	3 to 3
Teton WA	mandatory federal Class I	1	3	7 to 9	10 to 11
Theodore Roosevelt NP (North Unit)	mandatory federal Class I	0	0	1 to 2	2 to 3
Theodore Roosevelt NP (South Unit)	mandatory federal Class I	0	1	2 to 4	4 to 7
U.L. Bend WA	mandatory federal Class I	1	1	5 to 5	6 to 8
Washakie WA	mandatory federal Class I	3	5	11 to 14	16 to 18
Wind Cave NP	mandatory federal Class I	0	0	21 to 27	25 to 32
Yellowstone NP	mandatory federal Class I	1	3	9 to 11	12 to 13
Fort Peck IR	Tribal designated Class I	0	1	1 to 2	4 to 5
Northern Cheyenne IR	Tribal designated Class I	33	60	30 to 38	87 to 92
Absaroka-Beartooth WA	federal Class II	2	4	28 to 29	32 to 33
Agate Fossil Beds NM	federal Class II	0	0	10 to 15	14 to 19
Bighorn Canyon NRA	federal Class II	9	17	19 to 21	32 to 34
Black Elk WA	federal Class II	0	1	20 to 26	24 to 31
Cloud Peak WA	federal Class II	6	10	21 to 28	35 to 39
Crow IR	federal Class II	61	75	56 to 61	113 to 116

TABLE AQ-9
ALTERNATIVES B/C/E - DAILY FLAG REFINED METHOD - VISIBILITY IMPACT ANALYSIS
(NUMBER OF DAYS Δ1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alts B/C/E Project	Alts B/C/E Project + RFFA	Non-Project	Cum
Devils Tower NM	federal Class II	1	3	24 to 38	34 to 47
Fort Belknap IR	federal Class II	1	1	60 to 61	61 to 62
Fort Laramie NHS	federal Class II	0	1	13 to 17	16 to 20
Jewel Cave NM	federal Class II	0	0	24 to 31	28 to 36
Mount Rushmore NMem	federal Class II	0	0	17 to 22	20 to 26
Popo Agie WA	federal Class II	2	3	8 to 10	11 to 13
Soldier Creek WA	federal Class II	0	0	13 to 18	16 to 21

Source: Argonne (2002)

Notes: **Alts B/C/E Project** - Direct modeled Alternatives' B/C/E impacts.

Alts B/C/E Project + RFFA - Direct modeled Alternatives' B/C/E impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.

Non-Project - Direct modelednon-project source impacts. The impact from all air pollutant emission sources not included in **Alts B/C/E**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS sources. The range of values corresponds to including Wyoming Alternative 3 (low) to Wyoming Alternative 1 (high).**Cum** - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct **Alts B/C/E** Project and Non-Project impacts, which can occur at different locations. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Locations:

IR - Indian Reservation. **NHS** - National Historic Site. **NM** - National Monument

NMem - National Memorial. **NP** - National Park. **NRA** - National Recreation Area

WA - Wilderness Area.

TABLE AQ-10
ALTERNATIVE D - PREDICTED CRITERIA POLLUTANT IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS (IN (μG/M^3)

Pollutant	Avg Time [a]	Location	PSD Increment	Alt D Project	Alt D Project + RFFA	Non-Project	Cum	Back-ground	Total	NAAQS	MAAQS
carbon monoxide	1-hour	near-field	- - -	48	47.7	540	540.8	15,000	15,541	40,000	26,000
		far-field [1]	- - -	2	2.2	100	100.0	15,000	15,100	40,000	26,000
	8-hours	near-field	- - -	29	29.6	311.3	319.8	6,600	6,920	10,000	10,000
		far-field [1]	- - -	1	1.8	52	51.8	6,600	6,652	10,000	10,000
nitrogen dioxide	1-hour	near-field	- - -	50	59.6	181	195.1	117	312.1	- - -	566
		far-field [3]	- - -	33	32.7	27.5	43.9	117	160.1	- - -	566
	Annual	near-field	25	6.4	6.5	4.8	7.8	11	18.814.	100	100
		far-field [3]	25	2.4	2.8	1.1	3.5	11	5	100	100
		far-field [2]	2.5	1.1	2.0	0.5	**2.5**[e]	11	13.5	100	100
$PM_{2.5}$	24-hours	near-field	- - -	4.3	4.7	44.1	45.3	20	**65.3** [b]	**65** [b]	- - -
		far-field [3]	- - -	2.6	2.9	10.6	12.8	20	32.8	65	- - -
	Annual	near-field	- - -	1.2	1.2	5.6	6.0	8	14.0	15	- - -
		far-field [4]	- - -	<0.1	<0.1	1.2	1.2	8	9.2	15	- - -
PM_{10}	24-hours	near-field	**30** [c]	10.8	11.5	**103.8** [c]	**106.5** [c]	105	**211.5** [d]	**150** [d]	**150** [d]
		far-field [4]	30	0.1	0.2	29.7	29.7	105	134.7	150	150
		far-field [2]	**8** [c]	3.3	4.4	**8.4** [c]	**11.1** [c]	105	116.1	150	150
		far-field [5]	**8** [c]	0.6	0.9	7.2	**8.1** [c]	105	113.1	150	150
	Annual	near-field	17	3.3	3.4	13.1	14.1	30	44.1	50	50
		far-field [4]	17	<0.1	<0.1	2.7	2.7	30	32.7	50	50
sulfur dioxide	1-hour	near-field	- - -	4.5	4.5	27.4	28.2	666	694.2	- - -	1,300
		far-field [3]	- - -	2.2	2.2	29.6	29.6	666	695.6	- - -	1,300
	3-hours	near-field	512	3.5	3.5	22.6	23.6	291	314.6	1,300	- - -
		far-field [3]	512	1.7	1.8	17.1	17.1	291	308.1	1,300	- - -
	24-hours	near-field	91	2.1	2.1	9.8	10.5	73	83.5	365	260
		far-field [3]	91	1.0	1.1	5.3	5.3	73	78.3	365	260
	Annual	near-field	20	0.7	0.7	1.0	1.2	16	17.1	80	60
		far-field [3]	20	0.3	0.3	0.4	0.4	16	16.4	80	60

Source: Argonne (2002)

Notes: [a] Annual impacts are the first maximum value; short-term impacts are the second maximum value. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

[b] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 20 $\mu g/m^2$ were predicted to exceed the National ambient air quality standards due to **Cum** emission sources.

[c] It is possible that Non-Project and/or **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation and Washakie Wilderness Area, as well as the PSD Class II increment near the maximum assumed development; a regulatory "PSD Increment Consumption Analysis" should be conducted during permitting by the appropriate air quality regulatory agency.

[d] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 105 $\mu g/m^2$ were predicted to exceed the National and Montana ambient air quality standards due to **Cum** emission sources.

[e] Actual model results equal to 2.45 $\mu g/m^3$. See Argonne (2002) Appendix C, Table C.1.2.3.

Alt D Project - Direct modeled Alternative D impacts.

Alts D Project + RFFA - Direct modeled Alternatives' D impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt D**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.

Cum – Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alt D** Project and Non-Project impacts, which can occur at different locations.

Total - The sum of the cumulative modeled impact and the assumed background concentration.

NAAAQS - Applicable National Ambient Air Quality Standard.

MAAQS - Applicable Montana Ambient Air Quality Standard.

Locations:

1 – Absaroka-Beartooth Wilderness Area

2 – Northern Cheyenne Indian Reservation

3 – Crow Indian Reservation

4 – Fort Belknap Indian Reservation

5 – Washakie Wilderness Area

TABLE AQ-11
ALTERNATIVE D - PREDICTED ATMOSPHERIC DEPOSITION IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS

			Total Sulfur Deposition (kg/ha-yr)					Total Nitrogen Deposition (kg/ha-yr)					Acid Neutralizing Capacity (per cent)					
Location	**PSD Class**	**Lake**	**Alt D Project**	**Alt D Project + RFFA**	**Non-Project**	**Cum**	**Thld**	**Alt D Project**	**Alt D Project + RFFA**	**Non-Project**	**Cum**	**Thld**	**Bkgd (µeq/l)**	**Alt D Project**	**Alt D Project + RFFA**	**Non-Project**	**Cum**	**Thld**
Bridger WA	I	Black Joe	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.03	0.03	3	69.0	0.2	0.2	2.2	2.4	10
		Deep	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.03	0.03	3	61.0	0.2	0.2	2.5	2.7	10
		Hobbs	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.02	0.02	3	68.0	0.1	0.2	1.2	1.4	10
		Upper Frozen	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.03	0.03	3	5.8	0.1 [a]	0.13 [a]	**1.6** [a]	**1.7** [a]	**1** [a]
Fitzpatrick WA	I	Ross	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.02	0.02	3	61.4	0.2	0.2	1.7	1.9	10
Absaroka-Beartooth WA	II	Stepping Stone	<0.01	<0.01	0.02	0.02	5	<0.01	0.01	0.02	0.03	3	27.0	0.3	0.3	2.0	2.3	10
		Twin Island	<0.01	<0.01	0.01	0.02	5	<0.01	0.01	0.02	0.03	3	36.0	0.2	0.2	1.4	1.6	10
Cloud Peak WA	II	Emerald	<0.01	<0.01	0.03	0.03	5	0.01	0.02	0.07	0.09	3	53.3	0.6	0.7	4.4	5.2	10
		Florence	<0.01	<0.01	0.03	0.03	5	0.01	0.02	0.08	0.09	3	32.7	0.9	1.1	8.1	9.2	10
Popo Agie WA	II	Lower Saddlebag	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.03	0.03	3	55.5	0.2	0.2	3.2	3.4	10

Source: Argonne (2002)

Notes: **Alt D** Project - Direct modeled Alternative D impacts.

Alts D Project + RFFA - Direct modeled Alternatives' D impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt D**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alt D** Project and Non-Project impacts. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Thld - Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from FS (2000).

WA - Wilderness Area.

a - Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 µeq/l, the applicable significance threshold is less than a 1 µeq/l change. This threshold is exceeded by Non-Project and **Cum** emission sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

TABLE AQ-12
ALTERNATIVE D - DAILY FLAG REFINED METHOD - VISIBILITY IMPACT ANALYSIS (NUMBER OF DAYS >1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alt D Project	Alt D Project + RFFA	Non-Project	Cum
Badlands WA	mandatory federal Class I	0	0	17 to 25	20 to 26
Bridger WA	mandatory federal Class I	0	1	8 to 10	9 to 11
Fitzpatrick WA	mandatory federal Class I	0	0	7 to 9	8 to 10
Gates of the Mountains WA	mandatory federal Class I	0	0	3 to 4	3 to 4
Grand Teton NP	mandatory federal Class I	0	0	4 to 6	5 to 7
North Absaroka WA	mandatory federal Class I	0	1	10 to 12	12 to 14
Red Rock Lakes WA	mandatory federal Class I	0	0	0 to 1	1 to 2
Scapegoat WA	mandatory federal Class I	0	0	2 to 2	2 to 3
Teton WA	mandatory federal Class I	0	0	7 to 9	9 to 10
Theodore Roosevelt NP (North Unit)	mandatory federal Class I	0	0	1 to 2	1 to 2
Theodore Roosevelt NP (South Unit)	mandatory federal Class I	0	0	2 to 4	3 to 5
U.L. Bend WA	mandatory federal Class I	0	0	5 to 5	5 to 6
Washakie WA	mandatory federal Class I	1	1	11 to 14	14 to 16
Wind Cave NP	mandatory federal Class I	0	0	21 to 27	23 to 29
Yellowstone NP	mandatory federal Class I	0	0	9 to 11	11 to 12
Fort Peck IR	Tribal designated Class I	0	0	1 to 2	2 to 3
Northern Cheyenne IR	Tribal designated Class I	17	38	30 to 38	70 to 76
Absaroka-Beartooth WA	federal Class II	0	1	28 to 29	30 to 31
Agate Fossil Beds NM	federal Class II	0	0	10 to 15	12 to 17
Bighorn Canyon NRA	federal Class II	3	7	19 to 21	2 to 28
Black Elk WA	federal Class II	0	0	20 to 26	22 to 28
Cloud Peak WA	federal Class II	1	2	21 to 28	28 to 35
Crow IR	federal Class II	42	56	56 to 61	102 to 105
Devils Tower NM	federal Class II	0	0	24 to 38	29 to 42

TABLE AQ-12
ALTERNATIVE D - DAILY FLAG REFINED METHOD - VISIBILITY IMPACT ANALYSIS (NUMBER OF DAYS >1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alt D Project	Alt D Project + RFFA	Non-Project	Cum
Fort Belknap IR	federal Class II	0	0	60 to 61	61 to 61
Fort Laramie NHS	federal Class II	0	0	13 to 17	15 to 18
Jewel Cave NM	federal Class II	0	0	24 to 31	26 to 34
Mount Rushmore NMem	federal Class II	0	0	17 to 22	18 to 23
Popo Agie WA	federal Class II	0	1	8 to 10	9 to 11
Soldier Creek WA	federal Class II	0	0	13 to 18	14 to 20

Source: Argonne (2002)

Notes: **Alt D** Project - Direct modeled Alternative D impacts.
Alts D Project + RFFA - Direct modeled Alternatives' D impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.
Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt D**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS sources. The range of values corresponds to including Wyoming Alternative 3 (low) to Wyoming Alternative 1 (high).
Cum - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct **Alt D** Project and Non-Project impacts, which can occur at different locations. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Locations:
IR - Indian Reservation. **NHS** - National Historic Site. **NM** - National Monument
NMem - National Memorial. **NP** - National Park. **NRA** - National Recreation Area
WA - Wilderness Area.

9.0 Thresholds For Triggering Mitigation

9.1 Clean Air Act Regulatory Thresholds

For Prevention of Significant Deterioration (PSD) of air quality, modeled and monitored results for $PM_{10}$and NO_2 will be evaluated against the Class I and Class II increments to determine if additional mitigation will be required (see Table AQ-1).

Monitoring data only will be used to determine if the NAAQS PM_{10} and NO_2 standards (see Table AQ-1) have been exceeded. For federal lands with Class I areas, the Clean Air Act sets a 60-year goal of clear vistas. Clear vistas are defined as reduction in visibility not to exceed 1.0 deciview/year for more than 1 day. Where this threshold is exceeded from a single project, this could be the basis for the federal land managers' designation of visibility impairment. Such a designation could necessitate mitigation. Where the threshold is exceeded based on cumulative actions (i.e. RFFA), this also could be the basis for the federal land managers' designation of visibility impairment. In this instance, Congress directed federal land managers to implement mitigation pursuant to the Regional Haze Rule, in a manner that results in a 25% reduction in impairment every 15-year period to meet the 60-year clear vistas goal.

In order to prevent violations of national and local air quality standards, emission controls need to be implemented before standards are violated. For an analytic approach, implementation of control adequate to lead to no predicted cumulative violations are adequate, since all known and anticipated emissions will presumably be modeled within model uncertainties. NO_2 modeling of this well understood gas should be accurate enough to base mitigation decisions.

9.2 "Levels of Concern"

If mitigation measures are not fully implemented until regulatory thresholds are exceeded, then a regulatory process is triggered to resolve the exceedances. Such a process may be lengthy, costly and administratively burdensome. Agencies may wish to avoid such a process by establishing a "level of concern" short of regulatory thresholds, which would trigger implementation of control measures of a type and quantity sufficient to avoid reaching regulatory thresholds.

Where predictive capability is well-developed, as is the case with modeling of NO_2, an LOC might more closely approach the regulatory threshold. However, with a pollutant such as PM_{10}, greater uncertainties exist in the prediction of ambient concentrations due to such factors as differential particle settling. In such a case, an LOC may need to be established at a lower level to achieve the objective of avoiding regulatory exceedances.

9.3 Mitigation Measures

If air quality mitigation applied by all parties in the Powder River Basin are proven to be inadequate, cumulatively, to maintain these Class I and Class II increment limits based on regulatory air quality modeling or monitored conditions, Montana, Wyoming, or the Tribes may impose either a State or Tribal Implementation Plan (SIP or TIP) to assure preservation of the rural air quality. EPA may itself impose a Federal Implementation Plan (FIP) to obtain controls on all regulated pollutant emission sources in order to assure preservation of the rural air quality.

9.4 Mitigation

Tables AQ-13 and AQ-14 include the array of measures available to mitigate potential PM_{10} and NO_x impacts and the effectiveness of each measure.

TABLE AQ-13
FUGITIVE DUST MITIGATION MEASURES (PM10), EFFECTIVENESS AND COST

	Dust Sources					
	Disturbed Areas	**Unpaved Roads[1]**				
Mitigation Options	Establish plant cover for all disturbed lands by certain time (re-vegetation)	Water roads to attain certain percent moisture	Apply soil stabilizer	Set and enforce speed limit	Gravel roads	Pave road
Effectiveness	Level proportional to percentage of land cover	0 – 50% reduction in uncontrolled dust emissions	33 to 100% control efficiency	80% for 15 mph 65% for 20 mph 25% for 30 mph [2]	30% reduction	90% reduction
Estimated Cost	$/acre	$4000/mile	$2,000 to $4,000/mile per year	Unknown	$9,000/mile	$11,000 to $60,000/mile

[1]Improved and County roads
[2]Reductions assume 40 mile per hour base speed.

TABLE AQ-14
NITROGEN OXIDES (NOX) MITIGATION MEASURES EFFICIENCY

	No_x Emissions Sources[1]			
	Field Compressors	**Sales Compressors**	**Temporary Diesel Generators [2]**	**Heavy Equipment**
Mitigation Options/Efficiency	Implement Best Available Control Technology Typically results in a NO_x emission rate of about 1 g/bhp-hr	Implement Best Available Control Technology Typically results in a NO_x emission rate of about 1 g/bhp-hr	Register with State; will regulate as appropriate	Voluntary use of diesel engines

1 Using electric – powered compressor motors in place of the typical natural-gas fired compressor engines could eliminate direct NO_x emissions from compressor station locations.
[2]Wyoming is currently registering these generators to determine if No_x emissions are significant.